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# GUIDE TO AGRICULTURAL LAND USE

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Publications



ONTARIO MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS  
ONTARIO MINISTRY OF ENVIRONMENT AND ENERGY

 Ontario

Ministry of Agriculture,  
Food and Rural Affairs

## PREFACE

The *Guide to Agricultural Land Use* and the *Minimum Distance Separation (MDS) I and II* are the successors to the 1976 *Agricultural Code of Practice*. Taken together, they form a two-pronged approach to reducing land-use conflicts in rural areas.

The *Guide to Agricultural Land Use* introduces issues that sometimes arise between agriculture and other land uses in the Ontario countryside. It advises farmers on how to avoid or reduce conflicts with neighbours and environmental impacts through the use of appropriate farm practices and equipment. The *Minimum Distance Separation* formulas focuses on proper siting of buildings, whether for farm or non-farm purposes.

For farmers, the *Guide to Agricultural Land Use* provides general information on farm practices and a list of references to more detailed information. Farmers will also gain insight into the concerns of rural residents about agriculture.

For non-farm residents and farm residents not involved in livestock agriculture, the *Guide* is an introduction to some of the complex decisions and current practices required in modern agriculture. The booklet sets out the limitations to creating a totally inoffensive environment immediately adjacent to some agricultural facilities. Non-farm residents who make a choice to accept the advantages of country life must be prepared to accept the noise, odour and dust associated with normal farm practices.

**Abbreviations:** Throughout this guide, OMAFRA will be used to represent the Ontario Ministry of Agriculture, Food and Rural Affairs; MOEE will represent the Ontario Ministry of Environment and Energy.

**Further Information:** Suggestions are given for further reading. Most of these publications and other related information may be obtained from local offices of either OMAFRA or MOEE.

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# GUIDE TO AGRICULTURAL LAND USE

## INTRODUCTION

This *Guide* covers a range of farm practices on Ontario farms as they relate to land use. Some of these practices have the potential to cause conflicts with neighbours. Others may have a more subtle, yet detrimental, effect on the environment. Recommendations are given to help prevent or minimize the potential for conflicts or problems.

## USE OF LIVESTOCK MANURE AND OTHER ORGANIC RESIDUES

For centuries, livestock manure has been handled, stored, and spread on the land for recycling of nutrients. This section discusses the use of manure and other organic materials, mainly as nutrient sources for crop growth.

### The Crop Cycle

Manure is used most effectively when it is applied to soils that require nitrogen, phosphate and potash fertilizers for crop growth. Various crops have different requirements for these three principal nutrients. For example, crops such as corn respond to the nitrogen in manure, while legumes don't need the nitrogen in manure but may respond to its phosphate and potash.

### The Value of Manure

As much as 80 percent of the nitrogen, 75 percent of the phosphate and 90 percent of the potash contained in livestock feed ends up in the manure. About 50 percent (75 percent for poultry) of the nitrogen, 40 percent of the phosphate and 90 percent of the potash in manure are available in the year of application. The remaining phosphate and potash, as well as a small amount of the remaining nitrogen, are available to succeeding crops.

Nitrogen losses of up to 50 percent can occur during manure collection, storage, transfer and application. These losses are quite variable, depending mostly on the opportunities for contact of the manure with air. The nitrogen from manure applied in autumn is only half as available as nitrogen in manure applied in spring. Incorporating manure into the soil immediately after application in spring further reduces the nitrogen losses.

The value of phosphate and potash in manure is not affected by time of application. The phosphate content of manure that is surface-applied between corn rows may not, however, be readily available in the year of application. Manure applied to the same field year after year can dramatically increase the soil test levels of phosphate and potash, especially where the value of manure is not deducted from the fertilizer applied to the crops. This latter practice does not use manure nutrients efficiently, and from a nutrient management standpoint, is considered a poor practice.

The nutrient analysis of manure varies with the class of livestock, the feed, and the manure handling system. Sample manure analysis and crop fertility requirements are available in OMAFRA Publication 296 - *Field Crop Recommendations*. Since the nutrient content of manure can vary widely from one farm to the next, it is advisable to have manure sampled periodically to make more efficient use of the available nutrients.

### Use of Manure

The primary elements (nitrogen, phosphorous and potassium), as well as some trace elements, are common to all types of animal manure.

Since nitrogen is generally considered to be the most valuable plant nutrient in manure, it is often used as the base element in determining the amount of manure to be spread on a field or pasture. This, then, will vary from year to year depending on soil nutrient levels and the nutrient needs of the crop grown.

Nitrogen is easily lost to the atmosphere in its ammonium form. A manure system having ammonium losses as low as 18 percent would include a totally slatted floor, a covered storage, and manure spreading through soil injection. Ammonium losses as high as 84 percent can result from a system that includes solid floors, an open shallow storage (such as an earthen pit where the average depth is small), and a spreading system that involves irrigation and leaving the manure on the soil surface for more than 7 days. Spreading dry poultry manure and not incorporating can also result in high ammonia loss.

To choose a maximum-allowable spreading rate based on a specified number of animals per unit land area per year does not take into account the variability of the nitrogen losses. On any particular farm, for a given manure system and crop, the spreading rate of manure should be based on a nutrient management plan.

If manure applications are solely based on the nitrogen needs of the crops, in many cases, concentrations of phosphorus and potassium will increase to excessive levels. This is especially a concern with phosphorus that is usually firmly attached to soil particles. If soil erodes, high levels of phosphorus can get into streams, rivers, and lakes. As well, there is some potential for soluble phosphorus to leach through the soil into tile drains and groundwater.

### Determining the Land Area Needed for Manure Application

All manure should be applied in accordance with a nutrient management plan. A nutrient management plan is a written plan of action to handle manure in a way that does not harm the environment. A detailed plan should include manure nutrient testing, safe application rates, crop nutrient needs, area required for application, appropriate reductions in commercial fertilizer applications, and emergency actions in case of spills or system failures.

Available cropland is land that is planted and harvested with crops or improved pasture. It does not include land that is too far away or unsuitable for manure application. The available cropland should be owned or controlled by the livestock operation. An alternative to owning the land is to have an agreement with a neighbour to utilize the manure. When manure is spread on leased or neighbouring farmland, formal written agreements will help ensure that the land is available when needed for spreading. A nutrient management plan is the best way to determine safe application rates.

### Environmental Effects of Improper Manure Application

While manure benefits crops, it can also lead to problems when improperly handled and used. Problems can include crop damage, water pollution, and excessive odour.

Manure that is applied to foliage may cause crop damage. The buildup of nutrients in the soil over time can lead to poor crop response. This can vary from overly vigorous growth, resulting in lodging in cereal grains, to soil toxicity, which impedes crop growth altogether. Improper application of manure to orchards can result in winterkill. For this reason, the nutrient values of fertilizer and manure should both be taken into account when applied to crops. Phosphate and potash soil levels should be monitored by soil testing.

When high manure application rates are used, groundwater can be contaminated by bacteria and nitrogen, and surface water can be contaminated by bacteria, nutrients, toxic levels of ammonia, suspended solids and organic materials. Farm drinking water should be tested at least annually to assure adequate quality.

Manure handling, storage, and spreading can produce odours that neighbours find offensive. The intensity of manure odour will vary with the type of animal, the feed, the type of manure handling system, the manure spreading system, and the quantity of manure.

The intensity of the odour off-property also depends on wind direction and speed, and other weather conditions. Odours and their effect on neighbours can be minimized by:

1. considering separation distance — the further away, the less offensive the odour
2. taking advantage of special atmospheric conditions, such as a favourable wind direction and low humidity
3. completing the spreading in as few days as possible
4. incorporating the manure into the soil as soon as possible after spreading.

All farmers should be particularly concerned about the pollution potential of indiscriminate spreading of manure. The greatest fertility value for manure is realized when the manure is stored properly, spread and incorporated into the soil just prior to crop planting or during crop growth via inter-row application. This practice reduces odours, reduces nitrogen losses, improves crop responses and guards against runoff.

## **Sewage Sludge and Septage Utilization**

Stabilized sewage sludges with acceptable nitrogen-to-metal ratios are an excellent source of nitrogen and phosphate nutrients. They also supply smaller amounts of micronutrients essential for crop growth and organic matter for good soil structure. The *Environmental Protection Act* requires the prior approval of sludge and septage utilization operations and application sites. This ensures that odour and water pollution are minimized, and prevents an excessive build-up of heavy metals and other contaminants in the soil.

The *Guidelines For Sewage Sludge Utilization on Agricultural Lands* have been published jointly by OMAFRA and MOEE. The guidelines outline the quality standards for sludge applied to agricultural soils, the amount of nitrogen and metals that can be added to any soil, the crops that can be grown, and criteria for certification of utilization sites. Minimum distances of spreading from watercourses are listed to avoid water pollution problems, as well as minimum distances from individual houses and from residential areas, to minimize or avoid odour concerns.

## **Use of Farm and Non-Farm By-Products as a Soil Amendment**

Wastes from some food processing and other industries can be incorporated into the soil. Wastes from canneries, dairies, cheese factories, fish plants and abattoirs can add nutrients to the soil. Farm-generated wastes such as culled vegetables and fruits may also be used in soil. There are potential problems with such wastes. Odour is the primary concern. There is also the potential for water pollution and the possibility of detrimental effects from the contaminants present in many such wastes. Certain wastes have the potential to destroy the value of land for food production. Only materials that will have a beneficial effect should be added to the soil.

The *Draft Interim Guidelines for Utilization of Waste (Other Than Sewage Sludge) on Agricultural Lands* have been jointly published by

the OMAFRA and MOEE. MOEE approves the use of such wastes on a case-by-case basis. Each type of waste to be utilized must be analyzed for its components.

Waste fruit and vegetables from off-farm processing operations can be incorporated into the soil by following waste fruit and waste vegetable protocols. The protocols were developed by OMAFRA and MOEE in consultation with the respective industries.

## **Food Processing Waste as Animal Feed**

Some farmers are able to use food processing wastes and/or by-products as animal feed. Such material includes tomato and apple pressings, corn cobs and husks, sweet corn cannery waste, stale bakery products and spent brewery mash. Their use as feed can help a farmer to reduce overall feeding costs. Also, feeding these recyclable wastes to animals reduces the volume of solid waste that food processors must dispose of at an approved sanitary landfill or apply as a soil amendment.

Many of these food wastes are wet and/or decompose readily. Problems with odours, leachate and contaminated runoff may easily develop. To avoid such problems, farmers should tailor handling and storage arrangements to their situation and the waste or by-product they use. Some general guidelines to minimize odours and water quality problems include:

1. Provide adequate storage facilities (preferably covered) appropriate for the material.
2. Locate storage facilities away from, and where possible downwind of neighbours' residences.
3. Wherever possible, keep the volume of stored waste to a minimum and feed the material to animals as quickly as possible — this is especially important for wastes that decompose readily or that produce particularly strong odours (e.g. onions, cabbages).
4. Provide the feed in a trough or receptacle that will allow all the feed to be eaten rather than trampled into the ground.
5. To avoid water quality problems, collect, store and properly dispose of leachate or liquor from the stored material. It can be a highly concentrated pollutant.

## **SUGGESTED READING**

*From OMAFRA:*

- Field Crop Recommendations, Publication 296*  
*Manure for Crop Production, Agdex 100/538*  
*How and Where to Use Sewage Sludge in Crop Production, Agdex 100/541*  
*Use of Stabilized Sewage Sludge on Agricultural Land*  
*Legislation and Farming Practices, Agdex 700*  
*Nutrient Management Worksheet for Manure, Agdex 538/743*

*From OMAFRA and MOEE:*

- Guidelines for Sewage Sludge Utilization on Agricultural Lands*  
*Draft Interim Guidelines for the Utilization of Waste (Other than Sewage Sludge) on Agricultural Lands*  
*Protocol for the Utilization of Waste Vegetables on Agricultural Land*  
*Protocol for the Utilization of Waste Fruit on Agricultural Land*

## MANURE MANAGEMENT

While manure is a valuable resource for plant growth, it must be carefully managed. This section deals with some of the management factors in handling, storing and using livestock manure.

Consideration of neighbours is an important aspect of manure management. Manure should be stored and spread in such a way as to cause the least inconvenience to neighbours, minimize the potential for causing environmental harm and, at the same time, be of the most value as a fertilizer.

General farmstead appearance can have a bearing on the attitude of the community. Visual screening of manure storages has positive results. Good sanitation and fly control around buildings and manure storages are important. When transporting manure on public roads, use proper equipment to prevent spills and leaks.

Locating livestock buildings and manure storages in accordance with the *Minimum Distance Separation II* formula will significantly reduce the detection of odours off-property.

### Selecting a Manure Storage System

There are many factors to be considered when selecting a manure system. From an environmental viewpoint the system chosen should be able to provide:

1. Protection for groundwater and surface water.
2. Minimum odour levels.
3. A storage period of at least 200 days, with 250 days recommended for optimum flexibility. This ensures that the manure can be stored until it can be used efficiently on the land.
4. Safety and security.
5. Minimum nutrient losses during storage and handling.
6. Prevention and control of disease in the building.

Choice of the most appropriate system will also involve a consideration of the following:

1. The moisture content of the manure.
2. Labour efficiencies and costs of complete systems (including capital costs and operating costs).
3. The quality and adaptability of equipment and systems to meet present and future needs.
4. The location of storages in relation to streams, watercourses, wells, neighbours, roads, etc.
5. Size and type of spreading equipment to complete the job in as few days as possible — both to minimize the duration of odours and to proceed with other field operations.

### Types of Manure Systems

Manure systems can be designed to handle solid (stackable) or liquid manure.

**Solid manure** has sufficient bedding added so that it can be stacked in the storage. Solid manure retained in the barn does not generate the same odours as liquid manure. Most solid manure is removed from the barn with a stable cleaner or front end loader.

**Liquid manure** is produced when little or no bedding is used. Sometimes a dilution liquid is added so the manure has a moisture content high enough to make it suitable for pumping (over 90% moisture). Liquid manure is moved into storage by pumps or by gravity. The manure may be retained in temporary storage in the barn for weeks or even months.

### Storage of Manure and Nutrient-Enriched Liquids

Solid manure should be stored on a concrete pad, either covered or uncovered. A covering is normally a conventional roofed structure; however, a tarp may be used for broiler manure. Any runoff from the solid manure storage should be collected, stored, and handled as if it were liquid manure.

Liquid storages may be of several types, the most common being: open circular concrete or steel tanks, covered circular or rectangular concrete tanks, and earthen pits.

Special precautions must be taken when siting and designing earthen manure storages to prevent the possibility of seepage of nutrients and bacteria to groundwater or subsurface drainage systems. Factors involved include the hydraulic conductivity of the soil, depth to the water table, depth to bedrock, location of field tile, etc. Site investigation and design standards are listed in the OMAFRA *Agricultural Pollution Control Manual*.

Most liquid manure storages are anaerobic (little or no oxygen is present). The resulting odours and gases can be quite offensive. With in-barn liquid manure storages, fans or large sidewall openings with natural ventilation are required to remove the odours and gases generated. Ideally, fans should be located so that they are directed away from adjacent sensitive land uses. This will help reduce noise and odour complaints.

In most cases, liquid manure must be agitated before it can be removed from the storage. This results in a high concentration of odours and toxic gases generated. For in-barn liquid manure storages, all livestock and humans should be outside of the barn during agitation. Check for leaks in liquid manure storages by observing liquid levels.

### Manure and Waste Spreading Systems

Conventional open-type manure spreaders are used for distributing solid manure and other solid wastes evenly over the land.

Liquid manure can be spread by broadcasting onto the soil (tank spreader, drag hose, or travelling gun irrigation system) or by injection into the soil (tank spreader or "drag-hose" system). Injection is the preferred method to minimize odours, nutrient losses, and surface runoff.

Over-application of liquid manure should be avoided to prevent ponding and possible leaching to drainage tile. Tilling the soil prior to spreading liquid manure can help prevent the manure from leaching to drainage tile. Regular checking of tile discharge for polluted water is recommended during liquid manure spreading. If a problem is identified, stop spreading manure, prevent the contaminated tile discharge from leaving the farm, and notify MOEE staff immediately.

### Separation Distances for Land Application of Manure

Because of the odour associated with the spreading of manure, there are recommended separation distances from an incompatible use such as a neighbour's house. If solid manure is spread closer than 200 metres to an incompatible use, it should be incorporated into the soil within 24 hours. If liquid manure is to be spread within 300 metres of an incompatible use, then it should be injected or worked into the soil within 24 hours.

In all cases the handling and spreading of manure, particularly liquid manure, should take place in the shortest time period possible under conditions that will least inconvenience the neighbours.

## Separation Distances for Open Feedlots and Ranges

Sometimes, large concentrations of livestock and poultry are kept outside, with or without an associated barn or manure storage. This can occur with beef feedlots, deer yards, and with range-fed turkeys. With range-fed poultry, such as turkeys, the average number of birds may not be high, but the concentration around the feeders may be very high. In this case, the point source of odour will be concentrated within about 25 metres from the feeders.

Care should be given to the regular moving of feeders. Trampled areas should be seeded down if possible. Any manure buildup should be scraped and spread.

## Manure Treatment

The usual objectives of manure treatments over and above the conventional handling practices are one or more of the following: a) to change the physical characteristics of the manure; b) to control odour; or c) to produce gas for energy purposes. In general, treatment of manure has not proven to be economically feasible on Ontario farms. However, there are circumstances relating to the use or potential sale of a product that may make treatment necessary or practical.

Following is a brief discussion of some of the treatment options available:

**Low-Temperature Drying.** In poultry operations, ventilation air can be drawn across manure in the dropping pit. The manure dries as it is accumulated. Control of the drinking water system is very important in such an operation.

**Composting** under aerobic conditions is a relatively fast and low-odour biological process in which organic matter is broken down by bacteria and fungi to produce a dark-coloured humus, carbon dioxide, water and heat. To obtain a suitable raw material, most manures require the addition of dry material with a high carbon content.

Composting of agricultural waste products occurs on a wide range of operations, from the relatively small dairy farm to rather large mushroom operations.

**Aeration.** Air can be introduced into stored liquid manure by mechanical agitation, or under pressure with compressors or blowers. The resulting aerobic breakdown of manure is much less odorous than the more conventional anaerobic systems. However, this process requires a high energy input.

**Manure Additives.** Proprietary chemicals are frequently advertised for use in the odour control of manure. Selected bacteria and enzymes have also been marketed with similar claims of odour control. While some of the bacteria additives appear to work on some farms, in general, manure additives have not been a cost-effective alternative.

**Solid/Liquid Separation.** A mechanical separator can separate manure into a solid and liquid fraction. The solids can be stored and handled as solid manure, and similarly, the liquid portion can be stored and handled as liquid manure. The solids content of the liquid portion is typically quite low, making the liquid well-suited for irrigation or pumping long distances.

**Biogas Production.** Anaerobic digestion of manure to produce methane gas has the added benefit of helping to control odours. However, this practice is currently not considered to be economically feasible to produce gas for energy.

## SUGGESTED READING

*From OMAFRA:*

*Livestock Manure Storages, Agdex 400/721*

*Sizing of Manure Storages, Agdex 400/721*

*Safety Fencing of Manure Storages, Agdex 721/410*

*Storage of Liquid Manure, Agdex 721*

*Storage of Solid Manure, Agdex 721*

*Planning A Manure Transfer System, Agdex 725*

*Manure Characteristics, Agdex 538*

*Manure Gases, Agdex 538*

*Solids-Liquid Separation of Manure, Agdex 743*

*Best Management Practices — Livestock and Poultry Waste Management*

*Agricultural Pollution Control Manual*

*Poultry Manure Handling, Agdex 450/725*

*How to Handle Seepage from Farm Silos, Agdex 723*

## PROTECTION OF WATER QUALITY

A continued supply of good quality water is important to all. This section deals with the impact on surface water and groundwater by farm practices such as the storage and disposal of manure and other residues, tillage and conservation practices, and chemical handling. Farm practices must also be adjusted to local site conditions: what might be an accepted practice in one area may not be acceptable on an environmentally-sensitive soil.

Many farm practices can create risks to the farm's own drinking water supply. Also, there are statutory requirements and common law precedents relating to the maintenance of water quality. Two benefits of good water quality are reduced herd health costs and reduced water treatment costs.

There is growing awareness in the agricultural community that poor farm management practices can affect water quality. The main water quality problems and the typical farm-related causes are:

1. **High organic, nutrient or bacteria loadings to streams** can be toxic to aquatic life, encourage excessive aquatic plant growth and disrupt the oxygen balance.

Can be caused by:

- excessive manure application (either over a long term or for one application)
- runoff from feedlots, barnyards, and solid manure storages
- livestock access to streams
- over-application of chemical fertilizer
- uncontrolled drainage from feed storages
- soil erosion (mainly phosphorus)
- runoff of manure spread on wet or frozen fields
- manure "spills", which can occur because of insufficient or poorly-designed storage, or because of accidents during spreading
- direct connection to the field tile system of a milkhouse drain or domestic septic system
- movement of manure through soil macropores to tile drains

2. **Elevated levels of nitrate in groundwater.**

Can be caused by:

- excessive application of nutrients to the soil (whether manure, legume crop residue decay, commercial fertilizer, or a combination), especially if repeated year after year
- application of nutrients to, or having a feedlot on, environmentally sensitive soils

### **3. High odour levels in low-flowing streams or ditches.**

Can be caused by:

- runoff from feedlots, barnyards, and solid manure storages
- livestock access to streams (defecation and urination into or near the water)
- uncontrolled drainage from feed storages
- runoff of manure spread on wet or frozen fields
- manure “spills”, which can occur because of insufficient or poorly-designed storage, or because of accidents during spreading
- direct connection to the field tile system of a milkhouse drain or domestic septic system

### **4. High sediment loads in streams.**

Can be caused by:

- livestock access to streams (trampling the streambanks and disturbing the bottom sediments)
- wind and water erosion on adjacent fields, as well as streambank erosion within the channel

### **5. Toxic chemicals in surface water and/or groundwater.**

Can be caused by:

- over application of pesticides
- spills of pesticides or other chemicals (e.g. improper cleaning or disposal of containers and spray equipment)
- pesticide drift from improper application.

## **Land Application of Fertilizer, Manure, and Other Residues**

Land application of manure has already been discussed in some detail. The key to avoiding many of the problems is to take a nutrient management approach to using fertilizer, manure, and other nutrient sources. Only nutrients needed for crop production should be added to the soil.

### **Recommendations:**

1. Apply manure at rates based on crop nutrient needs and manure nutrient availability; remember to account for additions of commercial fertilizer and soil test results.
2. Provide a grassed buffer along watercourses to help trap eroded sediments and manure runoff.
3. Don't spread manure on frozen or snow-covered ground, or when the soil moisture content is high.
4. Incorporate chemical fertilizers and other nutrient sources. Manure should be incorporated into the soil within 24 hours of spreading whenever possible.
5. Don't spread manure when rain is expected in the next 24 hours.
6. Till the fields before applying liquid manure if macropore movement to tile drains is a concern.
7. Implement a contingency plan to provide for monitoring of discharges and emergency response capability.

### **SUGGESTED READING**

From OMAFRA:

*Spray Irrigation of Manure, Agdex 400/725*

*Comparison of Liquid Manure Spreading Systems, Agdex 743*

*Nitrogen Management in Conservation Tillage Systems for Corn, Agdex 111/570*

*Nitrogen Recommendations for Corn, Agdex 111/541*

*Nitrogen Fertilizer Materials for Field Crops, Agdex 111/542*

*Fertilizer Management in Conservation Tillage Systems Phosphate and Potash, Agdex 540*

*Ammonia Losses From Manure, Agdex 538*

*Field Crop Recommendations, Publication 296*

*Fruit Production Recommendations, Publication 360*

*Vegetable Production Recommendations, Publication 363*

*Best Management Practices — Livestock and Poultry Waste Management*

*Land Application of Liquid Manure in an Environmentally Responsible Manner, Agdex 538/743*

*Agricultural Pollution Control Manual*

## **Livestock Access to Streams**

For years, farmers have appreciated the advantage of being able to water livestock directly from watercourses adjacent to pastures. However, in many cases, little was done to control the pollution associated with this practice. Livestock trample the banks of the watercourse, contributing to erosion and interfering with drainage. Livestock defecate and urinate in the water as they drink.

### **Recommendation:**

1. Keep livestock from watercourses and provide alternate watering facilities.

### **SUGGESTED READING**

From OMAFRA:

*Farm Fencing Systems, Agdex 400/724*

*Livestock Watering Devices to Prevent Stream Access, Agdex 573*

*Fencing of Watercourses to Control Erosion, Agdex 751*

*Low Flow Mid-Level Stream and Ditch Crossings With Culverts, Agdex 751*

*Low Level Crossings, Agdex 573*

## **Drainage and Soil Conservation**

**Drainage** includes both surface and subsurface drainage. The purpose of drainage is to create an aerated root zone for satisfactory crop growth and a surface soil that is dry enough to carry farm machinery. Also, drainage contributes to the more efficient use of fertilizer and to soil warm-up. Drainage activities include new construction, cleanouts, maintenance, and reconstruction. Agricultural drainage brings significant benefits to Ontario farmers. Effective drainage enhances food production, but drainage can also transport materials that impair environmental quality. Under certain circumstances, it can produce such adverse effects as increased suspended solids, nutrients and chemicals in surface waters, higher water temperatures, and disturbance of fish and wildlife habitat.

**Runoff** can be defined as: a) water from precipitation and irrigation that runs off from field surfaces (also referred to as surface drainage or non-point source runoff), and b) flows from specific point sources such as feedlots and barnyards. A number of factors affect the quantity, quality, and rate of runoff. These include rainfall amount and intensity, slope of the land, soil type, tillage practices, nature of the cropping program, ground cover, and drainage.

Runoff associated with poor soil conservation practices can be sufficiently contaminated to cause deterioration of groundwater and surface water quality. Manure pile leachate, for example, because of

its concentration, has a much higher nutrient level than the same volume of raw municipal sewage. In other cases, such as phosphorus enrichment of streams (which is caused by soil erosion), the pollution is more subtle. Even though the net effect of any one farm may be relatively small, the cumulative effect of all the farms in a watershed or in the province can have a serious effect on the quality of water in individual streams or in the Great Lakes system.

In many cases, poor soil conservation practices do not pollute watercourses directly. Rather, they result in the deposition of contaminating substances that are subsequently transported to watercourses by water runoff.

Surface runoff carries suspended and dissolved materials. The carrying away of suspended soil particles is referred to as soil erosion. Eroded soil and compounds clinging to the soil particles act as pollutants. They may make water turbid, unfit to drink, cover fish-spawning areas and bottom-living organisms. Suspended particles can irritate sensitive fish membranes and gills.

Farmland soil erosion problems have two components: sheet erosion, and rill and gully formation. Although interrelated, they require quite different solutions.

**Sheet erosion**, caused by both wind and water, occurs over large areas of unprotected soil. It can lead to large annual losses of topsoil that often go undetected for many years until crop yields decline. The degree of sheet erosion is related to factors such as: soil structure, field practices including amount of surface residue or crop cover, internal drainage of the soil, soil type and erodibility, and degree and length of slope.

**Rill and gully formations** follow from concentrated surface water flows over unprotected soil. This phenomenon is more apparent than sheet erosion, and often receives more remedial action.

The success of structural measures to control rill and gully formation often depends on the adequate control of sheet erosion. Sheet erosion control reduces the sediment build-up in the structures, allowing them to perform their intended function. For example, a grassed waterway can fail if it merely becomes a sediment trap for uncontrolled sheet erosion on adjacent land. Controlling sheet erosion also reduces the quantity of surface runoff through increased water infiltration, thereby reducing the capacity requirements of structures, sometimes even eliminating the need for them.

#### Recommendations:

1. Practice conservation tillage that involves optimum timing and direction of tillage, appropriate machine choice and number of passes, and reduced tillage depth.
2. Practice conservation cropping that involves a choice of the optimum direction for the crop rows, in some cases strip cropping, cover cropping, crop rotation, and leaving adequate buffer strips, especially adjacent to drains or waterways.
3. Follow proper design, construction and maintenance practices for drainage systems and erosion control structures.
4. Consider planting windbreaks in strategic locations to protect farmland from wind erosion.
5. Maintain a grassed buffer of 5 metres minimum along channel banks.

#### SUGGESTED READING

##### From OMAFRA:

- Soil Erosion Causes and Effects, Agdex 572*  
*Control of Soil Erosion, Agdex 573*  
*Tillage Practices for Residue Management and Control, Agdex 100/516*  
*Soil Compaction, Agdex 510*  
*Surface Drainage, Agdex 554*  
*Drainage Benefits, Agdex 555*  
*Grassed Waterways, Agdex 751*  
*Tile Drainage Outlets, Agdex 573*  
*Considerations for Stable Open Ditch Construction, Agdex 751*  
*Gully Erosion Control, Agdex 573*  
*Strip Cropping for Water Erosion Control, Agdex 573*  
*Best Management Practices — A First Look*  
*Best Management Practices — Field Crop Production*  
*Best Management Practices — Horticultural Crops*  
*Planting and Maintaining Field Windbreaks, Agdex 572*

#### Pesticides

Producers involved in the production of food and fibre have the right, under the *Pest Control Product Act* and *Regulations*, to apply registered pesticides to their land, crops and livestock in accordance with label directions and with the schedule under the *Pesticides Act of Ontario*. All farmers using crop protection chemicals must successfully complete the Ontario Grower Pesticide Safety Course.

Monitor crops carefully to see if pest control is needed. When using chemicals and pesticides, farmers should be careful to use the appropriate quantities and dispose of rinse solutions properly. Special care should be taken to avoid the accidental contamination of farm water supplies by direct spills or back-siphoning of pesticides into wells or cisterns. Prepare an emergency plan in case of a pesticide leak or spill. The written plan should include the location of emergency equipment, emergency telephone numbers, clean-up methods and steps to follow.

#### Recommendations:

1. Confine the pesticide to the target area and do not allow it to drift or be oversprayed to non-target areas.
2. Empty containers, if not refillable, must be triple-rinsed before being brought to a pesticide container recycling depot or crushed for disposal in landfill sites.
3. Spray equipment must be fitted with an effective anti-backflow device in order to take public surface water (*Pesticides Act*).
4. Equipment should not be washed out in a manner that would directly or indirectly contaminate surface water or groundwater.
5. Pesticides must be stored in an area that is used exclusively for the storage of pesticides. Warning signs must be posted and the floor area should have a lip to contain any spilled pesticides. Floor must be impermeable.
6. Use refillable containers.
7. Purchase only what can be used in a season.
8. Plan for emergencies.
9. Adopt Integrated Pest Management (IPM) practices.

## SUGGESTED READING

### From OMAFRA:

*Guide to Handling and Applying Herbicides to Protect Water Supplies and Reduce Personal Injury, Agdex 607*  
*Pesticide Container Rinsing, Agdex 607*  
*Pesticide Contamination of Farm Water Supplies, Agdex 607*  
*Guide to Chemical Weed Control, Publication 75*  
*Pesticide Handling Facilities, Agdex 607*  
*Management of Pesticides on the Farm, Agdex 607*

### From MOEE:

*About Pesticides and the Environment*  
*Pesticides Control in Ontario*  
*Pesticide Spills*  
*Requirements for Transportation and Storage of Pesticides*

## Farmstead Water Supply and Wastewater Disposal

Wells should be located, if at all possible, uphill and away from farm buildings, septic systems, manure storages and milkhouse washwater systems. Wells should be properly capped and sealed to avoid contamination by surface runoff.

Recent studies have revealed significant pollution from improper installations of domestic septic systems and milkhouse washwater disposal systems. In some cases, these systems have been connected directly to tile drainage systems that empty into streams and rivers. These sources are major contributors of nutrients and bacteria in many watersheds, and should be remedied immediately.

Farm practices can affect not only groundwater quality, but also groundwater quantity. This is especially true in areas where water is drawn from shallow wells and ponds. When large volumes of water are taken, such as for irrigation, neighbouring supplies may be affected.

### Recommendations:

1. Ensure that there are no improper connections between septic tanks/tile leaching beds or milkhouse drains and field subsurface drainage systems or agricultural drains.
2. Ensure that a Permit to Take Water is acquired if more than 50,000 litres per day are to be taken as per requirements of the *Ontario Water Resources Act*.
3. Have the household septic tank system pumped out regularly, approximately every two to three years.
4. Have the well water tested for bacteria on at least an annual basis.

## SUGGESTED READING

### From OMAFRA:

*Water Quality for House and Barn, Agdex 716*  
*Planning a New Water Well, Agdex 716*  
*Water Quality and Pig Production, Agdex 400*  
*Water Requirements of Livestock Agdex, 400/716*  
*Care and Maintenance of a Rural Septic Tank System, Agdex 716*  
*Farm Water Supply: Water Treatment Systems, Publication 85*  
*Farm Water Supply: Water Supply and Distribution Systems, Publication 476*  
*Best Management Practices — Water Management*  
*Milking Centre Washwater Disposal, Agdex 410/725*

### From Agriculture and Agri-Food Canada:

*Planning Your Milkhouse, Publication 1620*

### From MOEE:

*Class 1,2, and 3 Sewage Systems*  
*Septic Tank Systems*  
*Environmental Living Volume 4: Protecting the Environment... at the Cottage*

## NOISE

Noise is unwanted sound — the wrong sound at the wrong time or place. Most people think of rural areas as quiet places and usually they are. But some agricultural activities in rural areas produce a lot of sound that can interfere with the activities of people nearby. This noise can be a problem, especially in the evening and during normal sleeping hours.

When noise problems develop and are left unresolved, they can result in bad relations between farmers and neighbours. The neighbours may suffer a loss of enjoyment of their property or worse, their health may suffer due to a loss of sleep.

The best thing is to avoid problems before they develop. Like odours from manure handling, it is not possible or necessary to eliminate all of the noise produced by certain farm operations. However, the farmer can act to minimize the noise. Good planning and design of operations and activities, and a common sense consideration of others should avoid most noise problems. The results are beneficial to all — less disturbance and fewer complaints and bad feelings. Also, where the farmer reduces noise at the source, this will almost certainly help preserve the farmer's own hearing.

Noise generated by a source may be annoying because it is heard over and above the level of the "ambient" or surrounding background sound level at a particular location. Sound level limits are therefore expressed as the difference between noise from a source and the ambient noise. In urban areas, the ambient noise is usually made up of pervasive road traffic noise that creates the background "urban hum". In rural areas, the acoustic environment is normally dominated by natural sounds such as wind blowing through trees, running water, birds, insects, etc. Road traffic is infrequent in most cases.

The most effective noise control measure is to keep a noise source and the neighbour an adequate distance apart.

## Specific Agricultural Noise Sources

The minimum separation distance or setback between a noise source and a point of reception is the distance required to ensure that the ambient noise level will not be exceeded at a residential point of reception. It is difficult to provide a comprehensive guideline on required setbacks due to the complex nature of sound propagation patterns. How a sound spreads out is affected by a number of variables such as the type of noise, the direction from which it is coming, the nature of the ground cover, atmospheric conditions, the cumulative effect of noise from operations of various sizes, and the effect of shielding and reflecting structures. The following guidelines were developed, assuming typical operations and average acoustical propagation factors.

**Bird Scaring Devices** — These devices are usually used to scare birds away from orchards, vineyards and other areas where birds can do damage. Two types are in common use: a) propane-fired bird bangers, and b) electronic warblers employing high frequency impulse sound (from 2 kHz upwards) at varying impulse rates.

Electronic warblers generate less objectionable noise than propane-fired bird bangers. The following measures will help to reduce the noise impact on neighbours:

1. Use bird bangers only when required for protection of specific crops and only when a problem is evident.
2. Operate bird bangers only between dawn and dusk.
3. Where possible, use directional sound-producing devices aimed away from neighbours.
4. Maintain the devices properly to avoid continuing noise when the bangers are shut off.
5. Locate devices as far from neighbours as possible.
6. At fur-bearing animal ranches, avoid the need for bird scaring devices by screening pens to reduce the attraction of birds.
7. Erect a noise barrier to keep noise from neighbours.

**Grain Drying Operations and Hay Dryers** — Grain dryers produce noise from fans, burners and the movement of grain by mechanical means. The fan/burner unit is the predominant source of noise. Older dryers with vane axial heating fans generate higher noise levels. Newer models, especially those that use a centrifugal air-foil blade fan, are only about half as loud. Older dryers can be refitted with newer, quieter fans. Noise produced from hay dryers is from the fans.

The noise impact on neighbours can be reduced by following these measures:

1. Site the structures as far as possible from neighbours using existing barns or silos as noise buffers if available.
2. Locate fans on the side of the building or dryer facing away from neighbours and direct the fan intake axis away from neighbours.
3. Use fans with low decibel ratings or fans with adjustable pitch blades that provide some control of noise level.
4. When possible, avoid nighttime operation of dryers.
5. Use noise barriers.
6. Enclose elevator fan/motor units.

**Ventilation Fans and Greenhouse Operations** — Farm ventilation fans should be directed away from residences. Mechanical ventilation fans and boiler units are the main sources of noise from greenhouses. Boiler unit operation does not usually result in serious noise impacts since most exhaust outlets are fitted with effective mufflers, and the installation itself is indoors. Follow the recommendations given for grain drying operations in order to reduce the noise impact on neighbours.

**Mechanical Farm Equipment** — Since most farm machinery is not stationary, no specific separation distance can be recommended. However, a number of actions can be taken to reduce or avoid noise problems:

1. Ensure the tractor muffler is functioning as designed.
2. Where possible, confine nighttime activity to those areas most remote from neighbours.
3. Avoid leaving tractors idling for prolonged periods near neighbouring homes.
4. Where possible, avoid nighttime operation of irrigation pumps located near neighbours.

5. If the equipment is to be used as a stationary power source, erect a noise barrier.

## Municipal Noise Control By-Laws

The maintenance of an adequate separation distance between a noise source and exposed neighbours is the most effective noise control measure. A municipality can control noise from agricultural operations and other sources through the adoption and implementation of the Model Municipal Noise Control By-law developed by the MOEE. The by-law is then administered locally by a Noise Control Officer designated by Council.

A small municipality may wish to control nuisance-type noise under a qualitative or subjective Noise Control By-law. The enforcement of this by-law requires only normal hearing and the judgement of a "reasonable person" on the part of the enforcing officer. Larger municipalities with more complex noise problems can control noise under a comprehensive or quantitative by-law. This type of control involves the use of scientific instruments to quantitatively describe the sound generated by various sources. Once the sound is described numerically, it is compared with an existing standard or limit for acceptability and the degree of compliance with this standard is determined.

## SUGGESTED READING

*From OMAFRA:*

*Reducing Odour and Noise Conflicts Between Rural Neighbours, Agdex 711/538,*  
*Odour, Noise and Dust Complaints and the Farm Practices Protection Act, Agdex 700*

*From MOEE:*

*Model Municipal Noise Control Bylaw*

## DEAD ANIMAL DISPOSAL

The disposal of dead farm animals is governed by the Ontario *Dead Animal Disposal Act*. Any dead animal (i.e. horses, goats, sheep, swine or cattle) must be either picked up by a licensed dead animal collector within 48 hours of death, or buried on the farm in an environmentally-safe place away from watercourses under 0.6 metres of soil within 48 hours of death.

Poultry mortalities should be stored in a freezer as soon as possible after death and held for pickup by a licensed dead animal collector, or buried on the farm in an environmentally-safe place away from watercourses and under 0.6 metres of soil. Poultry mortalities can be composted if properly managed in an on-farm composting facility that is designed and operated for that purpose. All dead animals must be disposed of in accordance with the *Dead Animal Disposal Act* or its successor.

## SUGGESTED READING

*From OMAFRA:*

*Proper Disposal of Dead Birds, Agdex 450/28*

RV-03-95-10M  
© Queen's Printer for Ontario, 1995  
ISBN 0-7778-4025-1 (3v.set)  
0-7778-4026-X (v.1)





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